

REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 9, 12, 14 and 20 are currently pending, Claims 12 and 20 having been amended, and Claim 19 having been presently canceled without prejudice or disclaimer. The changes and additions to the claims do not add new matter and are supported by the originally filed specification, for example, on Fig. 13.

In the outstanding Office Action, Claims 19-20 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement; Claim 19 was rejected under 35 U.S.C. §102(e) as being anticipated by Lee et al. (U.S. Patent No. 7,595,195, hereafter “Lee”); Claim 20 was rejected under 35 U.S.C. §103(a) as being unpatentable over Lee; Claims 9, 12, and 14 were rejected under 35 U.S.C. §103(a) as being unpatentable over Quake (U.S. Pub. No. 2002/0058332) in view of Chow et al. (U.S. Patent No. 6,149,787, hereafter “Chow”).

With respect to the rejection of Claim 20 under 35 U.S.C. §112, first paragraph, Applicants respectfully submit that the present amendment to Claim 20, reciting “fine satellite droplets” is supported on page 16, line 20, and thus overcomes this ground of rejection.

With respect to the rejection of Claim 20 under 35 U.S.C. §103(a), Applicants respectfully submit that the present amendment to Claim 20 overcomes this ground of rejection. Amended Claim 20 recites, *inter alia*,

(a) a microdroplet producing portion producing first and second primary microdroplets and first fine satellite droplets produced together with the first primary microdroplets and second fine satellite droplets produced together with the second primary microdroplets;

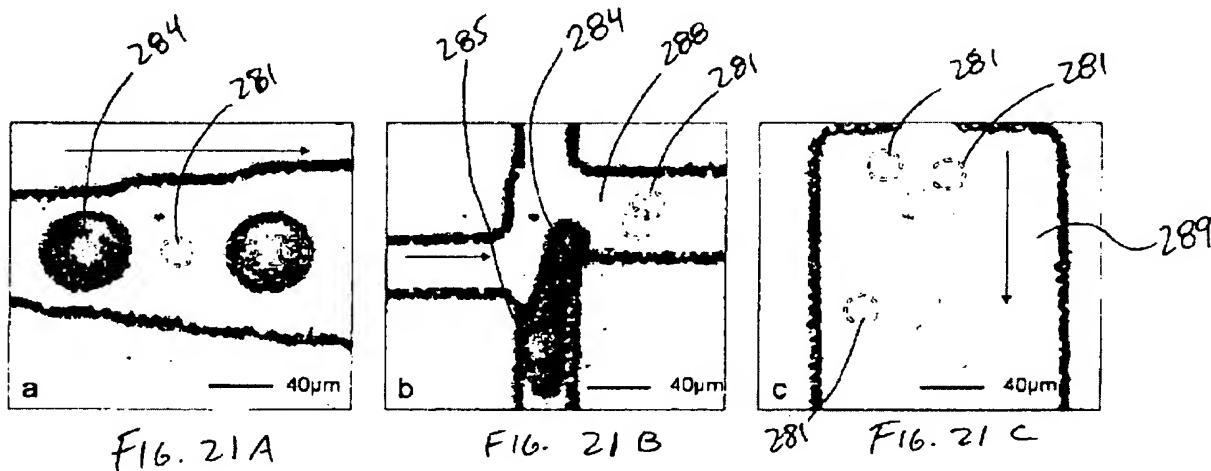
(b) a microdroplet supply channel supplying the first and second primary microdroplets and the first and

second fine satellite droplets from the microdroplet producing portion;

(c) an expansion portion connected to the microdroplet supply channel; and

(d) a branching portion having a primary droplet recovery channel connected to a front end of the expansion portion to recover the first and the second primary microdroplets, a first fine satellite droplet recovery channel positioned on one side of the primary droplet recovery channel to recover the first fine satellite droplets, and a second fine satellite droplet recovery channel positioned on the other side of the primary droplet recovery channel to recover the second fine satellite droplets.

Lee is directed to a system for controlling the size and composition of emulsified droplets (see Abstract). Figs. 20A and 20B of Lee show that droplets of different sizes may be sorted, where an input channel meets two daughter channels 264 and 266 at a T-junction (see col. 10, lines 50-63). Figs. 21A-21C of Lee (below) show that satellite droplets 281 can be separated from larger droplets 284.



Large and small satellite droplets are first generated in the microchannel (Fig. 21A), where the arrow indicates the direction of flow and the dash circles indicate the presence of a satellite droplet 281. Satellite droplets are carried by the flow into the upper channel 288, while large droplets 284 are pulled by shear and pressure forces into the lower channel 285 (Fig. 21B). Only satellite droplets 281 are observed in the collecting zone 289 for the upper channels 288 (Fig. 21C). (See col. 11, lines 1-10).

However, Lee does not describe “a microdroplet producing portion producing first and **second primary microdroplets** and first fine satellite droplets produced together with the first primary microdroplets and **second fine satellite droplets** produced together with the second primary microdroplets.” The Office Action appears to take the position that in the droplet formation process of Lee, there is programmable control of size and composition of droplets which would make it obvious to have second satellite and second primary droplets (see Office Action, at page 4, citing col. 3, lines 49-62 of Lee).

Notwithstanding this rationale, Lee clearly does not disclose or suggest “a branching portion having a primary droplet recovery channel connected to a front end of the expansion portion to recover the first and the second primary microdroplets, a first fine satellite droplet recovery channel positioned on one side of the primary droplet recovery channel to recover the first fine satellite droplets, and a second fine satellite droplet recovery channel positioned on the other side of the primary droplet recovery channel to recover the second fine satellite droplets.” In other words, Lee does not have two separate recovery channels on different sides of a primary droplet recovery channel for recovering two different types of fine satellite droplets.

Therefore, Applicants respectfully submit that amended Claim 20 patentably distinguishes over Lee.

Quake and Chow have been considered but fail to remedy the deficiencies of Lee with regard to amended Claim 20. Therefore, Applicants respectfully submit that amended Claim 20 patentably distinguishes over Lee, Quake, and Chow, either alone or in proper combination.

With respect to the rejection of Claim 9 under 35 U.S.C. §102(b), Applicants respectfully traverse this ground of rejection. Claim 9 recites, *inter alia*,

- (a) a cross intersection portion at which a first continuous phase supplied from a continuous phase supply

channel, a first dispersion phase supplied from a first dispersion phase supply channel, and a second dispersion phase supplied from a second dispersion phase supply channel intersect with each other;

(b) a first liquid feed device controlling the first dispersion phase;

(c) a second liquid feed device controlling the second dispersion phase; and

(d) a control device connected to the first liquid feed device and the second liquid feed device,

wherein (e) the first liquid feed device and the second liquid feed device are controlled by a signal from the control device so that microdroplets formed of the first dispersion phase and microdroplets formed of the second dispersion phase are sequentially produced.

As previously presented, in a non-limiting example of the invention defined by Claim 9, Applicants' Fig. 1 shows (a) an intersection portion (7), which is a cross intersection portion, at which a first continuous phase (2) supplied from a continuous phase supply channel (1), a first dispersion phase (4) supplied from a first dispersion phase supply channel (3), and a second dispersion phase (6) supplied from a second dispersion phase supply channel (5) intersect with each other; (b) a first liquid feed device (12) controlling the first dispersion phase (4); (c) a second liquid feed device (13) controlling the second dispersion phase (6); and (d) a control device (11) connected to the first liquid feed device (12) and the second liquid feed device (13), wherein (e) the first liquid feed device (12) and the second liquid feed device (13) are controlled by a signal from the control device (11) so that microdroplets (9) formed of the first dispersion phase (4) and microdroplets (10) formed of the second dispersion phase are sequentially produced.

The examiner cites to paragraph [0119] of Quake, which describes that there are two or more droplet extrusion regions introducing droplets of samples into the main channel.

Quake also describes in paragraph [0119] that the second droplet extrusion region is

downstream from the first droplet extrusion region, as illustrated in Fig. 22 of Quake shown below.

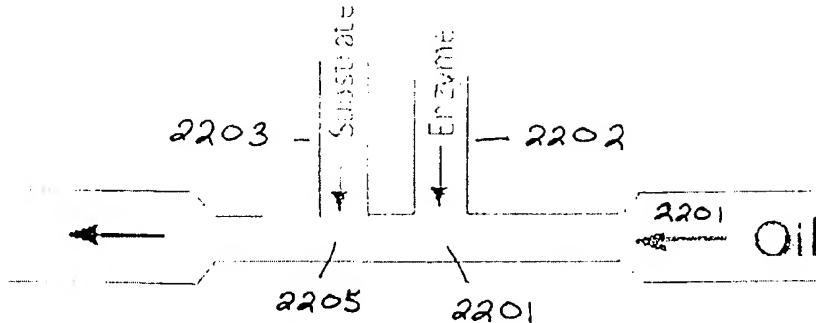


FIG. 22

Therefore, Quake describes a plurality of T-shaped intersections to supply different microdroplets to the continuous phase. However, Quake does not disclose or suggest “*a cross intersection portion at which a first continuous phase supplied from a continuous phase supply channel, a first dispersion phase supplied from a first dispersion phase supply channel, and a second dispersion phase supplied from a second dispersion phase supply channel intersect with each other.*”

The Office Action also cites to paragraph [0115] of Quake as describing that the droplet extrusion region can be controlled such that the periodicity of the droplets generated can be regulated. However, controlling the periodicity for a single droplet extrusion region is not the same as controlling two separate droplet extrusion regions so that the droplets from the two separate droplet extrusion regions are *sequentially produced*. In other words, if two separate droplet extrusion regions in Quake are *independently* controlled for their periodicity, then that does not mean that the droplets from the two regions will be controlled together to be sequentially produced. Therefore, Quake does not explicitly disclose or suggest “the first liquid feed device and the second liquid feed device are controlled by a signal from the

control device so that microdroplets formed of the first dispersion phase and microdroplets formed of the second dispersion phase are sequentially produced," as required by Claim 9.

The Office Action acknowledges that Quake fails to disclose or suggest a cross intersection (see Office Action, at page 5). The Office Action relies on Chow to remedy this deficiency of Quake with regard to Claim 9.

Chow discloses a method, apparatus and system for introducing large numbers of different materials into a microfluidic analytical device. In particular, Chow describes the following on col. 10, line 45 to col. 11, line 13:

In a basic cross channel structure, where a single horizontal channel is intersected and crossed by a single vertical channel, controlled electrokinetic material transport operates to controllably direct material flow through the intersection, by providing constraining flows from the other channels at the intersection. For example, assuming one was desirous of transporting a first material through the horizontal channel, e.g., from left to right, across the intersection with the vertical channel. Simple electrokinetic material flow of this material across the intersection could be accomplished by applying a voltage gradient across the length of the horizontal channel, i.e., applying a first voltage to the left terminus of this channel, and a second, lower voltage to the right terminus of this channel, or by allowing the right terminus to float (applying no voltage). However, this type of material flow through the intersection would result in a substantial amount of diffusion at the intersection, resulting from both the natural diffusive properties of the material being transported in the medium used, as well as convective effects at the intersection.

In controlled electrokinetic material transport, the material being transported across the intersection is constrained by low level flow from the side channels, e.g., the top and bottom channels. This is accomplished by applying a slight voltage gradient along the path of material flow, e.g., from the top or bottom termini of the vertical channel, toward the right terminus. The result is a "pinching" of the material flow at the intersection, which prevents the diffusion of the material into the vertical channel. The pinched volume of material at the intersection may then be injected into the vertical channel by applying a voltage gradient across the length of the vertical channel,

i.e., from the top terminus to the bottom terminus. In order to avoid any bleeding over of material from the horizontal channel during this injection, a low level of flow is directed back into the side channels, resulting in a "pull back" of the material from the intersection.

Therefore, Chow merely describes using the vertical channel **to prevent diffusion** of the material flowing from left to right across the horizontal channel **to by introducing a voltage in the vertical channel** which pinches the material flow at the intersection. However, Chow does not utilize the cross channel structure to provide an intersection at which "*a first continuous phase supplied from a continuous phase supply channel, a first dispersion phase supplied from a first dispersion phase supply channel, and a second dispersion phase supplied from a second dispersion phase supply channel intersect with each other.*" Chow also does not describe that upper and lower inputs to the vertical channel are connected a first liquid feed device and a second liquid device such that "the first liquid feed device and the second liquid feed device are controlled by a signal from the control device so that microdroplets formed of the first dispersion phase and microdroplets formed of the second dispersion phase are sequentially produced."

Therefore, a person of ordinary skill in the art would not take the cross channel structure described in Chow and apply it to Quake to achieve all of "(a) a cross intersection portion at which a first continuous phase supplied from a continuous phase supply channel, a first dispersion phase supplied from a first dispersion phase supply channel, and a second dispersion phase supplied from a second dispersion phase supply channel intersect with each other; (b) a first liquid feed device controlling the first dispersion phase; (c) a second liquid feed device controlling the second dispersion phase; and (d) a control device connected to the first liquid feed device and the second liquid feed device, wherein (e) the first liquid feed device and the second liquid feed device are controlled by a signal from the control device so

that microdroplets formed of the first dispersion phase and microdroplets formed of the second dispersion phase are sequentially produced,” as required by Claim 9.

As stated in MPEP §2141.02, “[i]n determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious.”<sup>1</sup>

Therefore, Applicants respectfully submit that Claim 9 (and all associated dependent claims) patentably distinguishes over Quake and Chow, either alone or in proper combination.

Lee has been considered but fails to remedy the deficiencies of Quake and Chow with regard to Claim 9. Therefore, Applicants respectfully submit that Claim 9 (and all associated dependent claims) patentably distinguishes over Quake, Chow, and Lee either alone or in proper combination.

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<sup>1</sup> *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983).

Consequently, in light of the above discussion and in view of the present amendment, the outstanding grounds for rejection are believed to have been overcome. The present application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested. Furthermore, the examiner is kindly invited to contact the Applicants' undersigned representative at the phone number below to resolve any outstanding issues.

Respectfully submitted,

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